Robot Application Development Using a Library of Reactive Control Actions, Phase I

Completed Technology Project (2017 - 2017)

Project Introduction

Future NASA missions will require robots that are adaptable in the face of dynamic and unpredictable environments. Existing robot systems have largely relied on a combination of highly-controlled, known environments and slow, carefully preplanned motions that require intensive human preparation and oversight. This strategy leaves little room for variation or adaptability in the face of unforeseen errors and limits the amount of direct interaction the robot can have with its environment. Consider the Space Station Remote Manipulator System (SSRMS) arm. This system is used to grapple payloads docking with the ISS and to transport astronauts for EVA operations. In the first case, the payloads remain essentially stationary relative to the ISS, while in the second, the manipulator remains stationary during the actual EVA activity. The current SSRMS software simply does not support dynamic activities such as acquiring a moving object, nor does it allow the astronauts to use its capabilities to assist them during the EVA task. Similarly, consider the tasks performed by the R5 humanoid robot during both the DARPA Robotics Challenge and for the ongoing NASA Space Robotics Challenge. These tasks include manipulating objects such as communication dishes, valves and buttons that are placed in fixed locations. In each case, the robot is commanded to perform a series of carefully constructed actions, typically relying on a remote human operator to react at rates slower than necessary for many crucial tasks. Handling non-rigid soft goods, grabbing a tool from a human co-worker, or using a wrench to tighten a bolt with a specific torque are well beyond the current mission capabilities. To address these challenges, we propose an application development framework in which both experts and non-experts can draw upon a set of reactive control actions to quickly program complex robots to perform complex tasks, expanding their capabilities and advancing the state of the art.

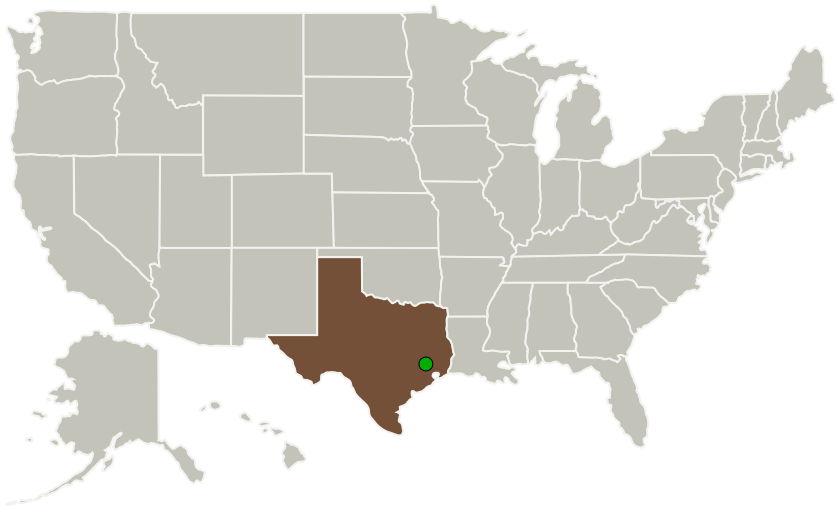
Robot Application Development Using a Library of Reactive Control Actions, Phase I Briefing Chart Image

Table of Contents

Robot Application Development Using a Library of Reactive Control Actions, Phase I

Completed Technology Project (2017 - 2017)

Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
TRACLabs, Inc.	Lead Organization	Industry	Webster, Texas
Johnson Space Center(JSC)	Supporting Organization	NASA Center	Houston, Texas

Primary U.S. Work Locations
Texas

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

TRACLabs, Inc.

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

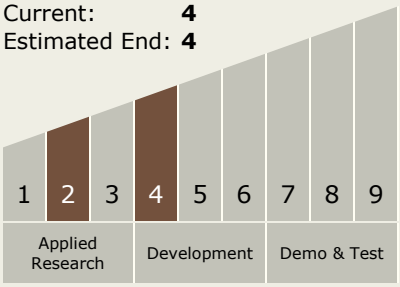
Carlos Torrez

Principal Investigator:

Stephen W Hart

Technology Maturity (TRL)

Start: **2**
Current: **4**
Estimated End: **4**



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Images

Briefing Chart Image
Robot Application Development Using a Library of Reactive Control Actions, Phase I Briefing Chart Image
(https://techport.nasa.gov/image/128843)

Technology Areas

Primary:

- TX10 Autonomous Systems
  - TX10.2 Reasoning and Acting
    - TX10.2.4 Execution and Control

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System